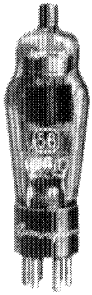
Cunningham RADIO TUBES

C-58



TRIPLE-GRID SUPER-CONTROL AMPLIFIER

The 58 is a triple-grid super-control amplifier tube recommended especially for service in the radio-frequency and intermediate-frequency stages of a-c receivers designed for its characteristics. The 58 is characterized by the small overall size, the dome-top bulb, and the fifth electrode or suppressor with its own base pin terminal. Equally significant among its electrical features are the relatively low heater power consumption, the extended mutual conductance operating range, and the adaptability of electrode combinations to various circuit applications. The ability of this tube to handle usual signal voltages without cross-modulation and modulation-distortion makes it uniquely adaptable to the r-f and i-f stages of receivers employing automatic volume control. Shield construction and bulb shape are discussed under Type 57, which is similar in structural appearance.

When the suppressor is not connected directly to the cathode, its utility may be extended. The suppressor, in suitable circuits, provides a means for obtaining the desirable conditions of reduced selectivity for local reception. This operational characteristic makes possible improved loudspeaker response when the receiver is tuned to powerful nearby stations.

CHARACTERISTICS

Heater Voltage (A. C. or D. C.)	2.5	Volts
Heater Current	1.0	Ampere
Plate Voltage	250 *max.*	Volts
Screen Voltage	100 *max.*	Volts
Grid Voltage	−3 *min.*	Volts
Plate Current	8.2	Milliamperes
Screen Current	3.0 *max.*	Milliamperes
Plate Resistance	800000	Ohms
Amplification Factor	1280	
Mutual Conductance	1600	Micromhos
Mutual Conductance — At −40 volts bias	10	Micromhos
Mutual Conductance — At −50 volts bias	2	Micromhos
Effective Grid-Plate Capacitance (with shield-can)	0.010 *maximum*	μμf.
Input Capacitance	5.2	μμf.
Output Capacitance	6.8	μμf.
Overall Length	$4\frac{19}{32}$" to $4\frac{27}{32}$"	
Maximum Diameter	$1\frac{9}{16}$"	
Bulb (See page 42, Fig. 7)	ST-12	
Cap	Small Metal	
Base	Small 6-Pin	

INSTALLATION

The **base** pins of the 58 fit the standard six-contact socket which may be installed to hold the tube either in a vertical or in a horizontal position. For horizontal operation, the socket should be positioned with its heater pin openings one vertically above the other. For socket connections, see page 39, Fig. 11.

The **heater** is designed to operate at 2.5 volts. The transformer winding supplying the heater circuit should be designed to operate the heater at this recommended value for full load operating conditions under average line voltage.

For **cathode** connection, refer to **cathode,** type 56.

Control grid bias variation will be found effective in changing the volume of the receiver. In order to obtain adequate volume control, an available grid bias voltage

of approximately 50 volts will be required. The exact value will depend upon the circuit design and operating conditions. This voltage may be obtained, depending on receiver requirements, from a potentiometer across a fixed supply voltage or by the use of a variable self-bias resistor in the cathode circuit.

The **screen** voltage may be obtained from a potentiometer or bleeder circuit across the B-supply source. Due to the screen current characteristics of the 58, a resistor in series with the high-voltage supply may be employed for obtaining the screen voltage provided the cathode-resistor method of bias control is used. This method, however, is not recommended if the high voltage B-supply exceeds 250 volts. Furthermore, it should be noted that the use of a resistor in the screen circuit will have an effect on the change in plate resistance with variation in suppressor voltage in case the suppressor is utilized for control purposes.

The **suppressor** may be connected directly to the cathode or it may be made negative with respect to the cathode. For the latter condition, the suppressor voltage may be obtained from a potentiometer or bleeder circuit for manual volume and selectivity control, or from the drop in a resistor in the plate circuit of the automatic volume control tube.

Shielding requirements are similar to those for type 57.

APPLICATION

As a **radio-frequency amplifier,** the 58 is especially applicable to radio receiver design because of its ability to reduce cross-modulation effects, its remote "cut-off" feature, and its flexible adaptability to circuit combinations and to receiver design. Recommended conditions for the 58 as an amplifier are given under CHARACTERISTICS.

To realize the maximum benefit of the long "cut-off" feature of this tube, it is necessary to apply a variable grid bias and to maintain the screen at a constant potential with respect to the cathode. However, good results may be obtained by using a variable cathode resistance which, of course, reduces the screen potential with respect to the cathode by the same amount that the bias is increased, thus hastening the "cut-off" and reducing the ability of the tube to handle large signals. This undesirable effect may be nullified by means of a series resistor in the screen circuit.

The use of series resistors for obtaining satisfactory control of screen voltage in the case of four-electrode tubes is usually impossible because of secondary emission phenomena. In the 58, however, the suppressor practically removes these effects and it is therefore possible to obtain satisfactorily the screen voltage from the plate supply or from some high intermediate voltage providing these sources do not exceed 250 volts. With this method, the screen to cathode voltage will fall off very little from minimum to maximum value of cathode-control resistor. In some cases, it may actually rise. This rise of screen to cathode voltage above the normal maximum value is allowable because the screen and the plate current are reduced simultaneously by a sufficient amount to prevent damage to the tube. It should be recognized in general that the series resistor method of obtaining screen voltage from a higher voltage supply necessitates the use of the variable cathode-resistor method of controlling volume. When screen and control grid voltages are obtained in this manner, the remote "cut-off" advantage of the 58 may be fully realized.

As a **frequency converter** or a **superheterodyne first detector,** the 58 may be used to advantage. It is capable of producing under the proper conditions of grid and local oscillator voltage, a gain in the first detector stage of about one-third that which can be obtained in an intermediate-frequency amplifier stage. In addition, this gain can be controlled as in the case of the radio-frequency amplifier by varying the grid bias either from a separate supply or from a variable resistor in the cathode circuit. This is a particularly desirable feature in receivers employing automatic volume control, because it enables a much lower threshold input to be received without loss of amplification and permits the reception of high input voltages without loss of control. Recommended conditions for the 58 as a superheterodyne first detector follow: Plate voltage, 250 volts; screen voltage, 100 volts; and

grid bias voltage, –10 volts minimum (with 9-volt oscillator peak swing). With an oscillator peak swing of 1 volt less than the grid bias, these values are not critical and may be chosen to meet circuit design requirements.

As a **grid bias detector,** the 58 is not recommended. This is because the intentional elimination of a definite "cut-off" makes the 58 rather insensitive and renders any approach to linear detection impracticable.

